Haruki HIRABAYASHI*: **Chromosome numbers in Japanese *species* of *Dryopteris* (2)**

平林春樹*: 日本産オシダ属の染色体数 (2)

This paper is a continuation of the previous report (**41**: 11–13 of this Journal, 1966). Tab. 1 includes chromosome counts for 12 species of *Dryopteris*. According to H. Ito (1939), these species are classified as follows:

No. 1– 8 *D. erythrosora*-Group } Subsect. Erythro-variae } Sect. Polysticho-drys
9–11 *D. varia*-Group
12 *D. gymnosora* Subsect. Gymnosorae

***D. erythrosora*-Group** *D. kinkiensis* is a tetraploid species having n=82 and may be sexual, since this species has sixteen-celled sporangia which give 64 spores.

Tab. 1. Chromosome numbers of *Dryopteris* Sect. Polysticho-drys.

No.	Species	Locality	Chromosome number (n)	Reproduction
1	*D. erythrosora* O. Kuntze Benisida	Agano, Saitama Pref.	123 c. 82	apogamous
2	*D. nipponensis* Koidzumi Togokusida	Owase, Mie Pref.	123 82	〃
3	*D. hondoensis* Koidzumi Obenisida	Izu, Sizuoka Pref.	123 c. 82	〃
4	*D. kinkiensis* Koidzumi Gihubenisida	Owase, Mie Pref.	82	sexual
5	*D. indusiata* Makino et Yamamoto Nukaitatisidamodoki	〃	82	apogamous
6	*D. championi* Ching Saikokubenisida	〃	123 c. 82	〃
7	*D. fuscipes* C. Chr. Marubabenisida	〃	123 c. 82	〃
8	*D. decipiens* O. Kuntze Natikuzyaku	〃	123 c. 82	〃
9	*D. saxifraga* H. Ito Iwaitatisida	Sirayasawa, Saitama Pref.	41	sexual
10	*D. bissetiana* C. Chr. Yamaitatisida	Takaosan, Tokyo Pref.	123 c. 82	apogamous
11	*D. varia* O. Kuntze Itatisidamodoki	Owase, Mie Pref.	82	〃
12	*D. gymnosora* C. Chr. Nukaitatisida	〃	123 82	〃

* Toho Gakuen Junior College, Chofu, Tokyo. 東京都調布市若葉町, 桐朋学園大学短期大学部.

D. indusiata shows 82 pairs of chromosome, and may be apogamous, for 32 spores are produced in each sporangium.

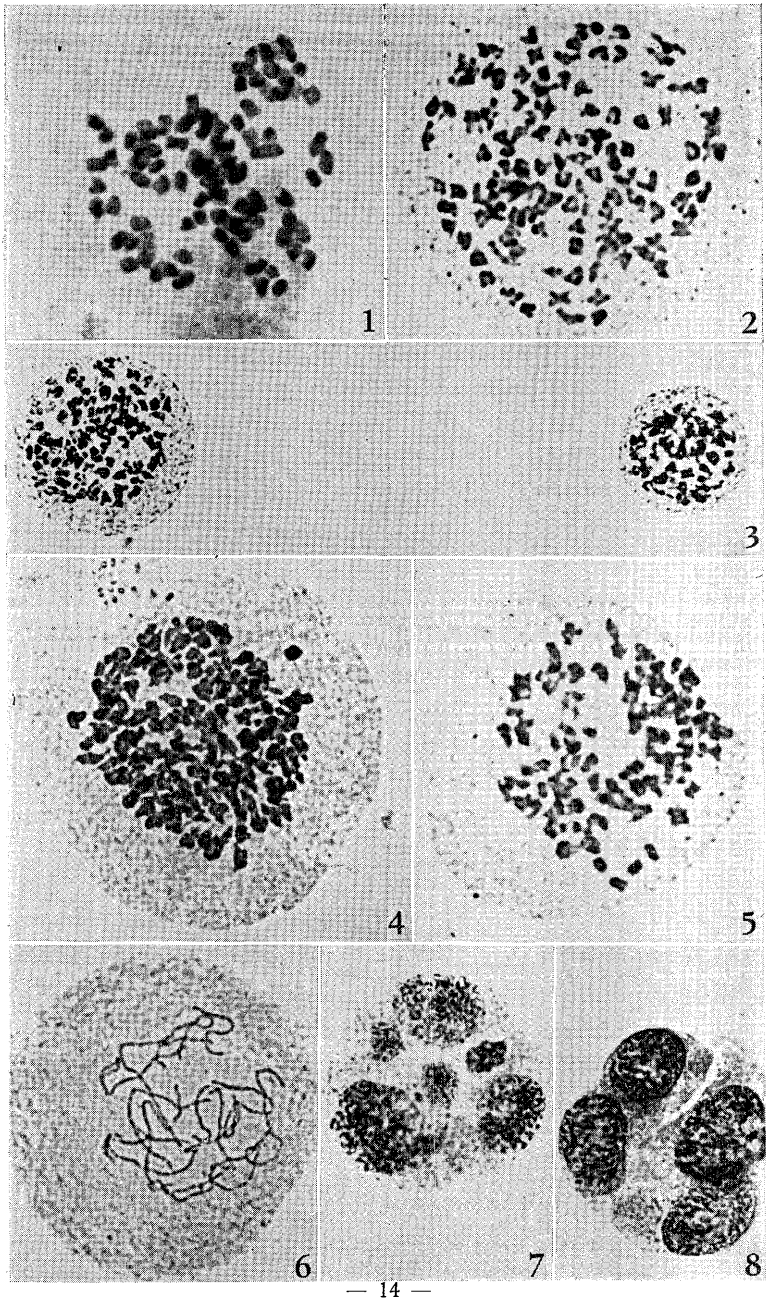
According to the author's present study, two different chromosome numbers are observed sometimes in *D. nipponensis* at the first meiotic metaphase in the spore mother cells from the same sorus. One has the number n=123 and the other has n=82. These two phases in chromosome number, the triploid and diploid phases, are found not only in *D. nipponensis* but in all the following five species: *D. erythrosora*, *D. hondoensis*, *D. championi*, *D. fuscipes* and *D. decipiens*.

Kurita (1961, 1962 and 1966) reported the number n=123 and suggested apogamous reproduction in each of *D. championi*, *D. erythrosora* and *D. nipponensis*. Later the author (1966) reported the number n=123 for *D. erythrosora* and *D. hondoensis*. In these previous studies, however, the presence of two phases in the same sorus or individual was not reported. Fig. 1 shows diploid phase having n=82 in *D. nipponensis* and Fig. 2 shows triploid phase having n=123 in *D. fuscipes*. Fig. 3 shows two unequal-sized spore mother cells in the same field of a preparation from *D. decipiens*. The left is the high-numbered cell (probably triploid phase) and the right is the low-numbered (probably diploid phase). As shown in these figures, size of the cell is generally larger in the high-numbered than in the low-numbered. The proportion of these phases in each species is yet unknown.

D. varia-Group *D. saxifraga* is diploid species having n=41 and may be sexual, since this gives 64 spores in each sporangium. Chromosome number of *D. varia* is known to be n=82 in a specimen from Nati by the author (1966). This number was counted now again by the author in a specimen from Owase. Since one sporangium yields 32 spores, the plant may be apogamous.

The author (1966) reported the number n=82 for *D. bissetiana* (under the name of *D. varia*) from Chofu, and Mitui (1966) found the number n=123 in the same species. This similarly suggested the presence of two phases in the same species.In the present study, two phases were observed in *D. bissetiana* from Takaosan. Fig. 4 shows a triploid phase having n=c.120, and Fig. 5 a diploid phase having n=c. 80 in this species. Furthermore, in the same species the author found an unexpected pattern showing zygotene chromsomes in very small number as

Fig. 1. *D. nipponensis* n=82 (diploid form). Fig. 2. *D. fuscipes* n=123 (triploid form). Fig. 3. *D. decipiens*, showing two phases in the same field. Figs. 4-8. *D. varia*. 4. Triploid form. 5. Diploid form. 6. Zygotene chromosomes. 7. Abnormal hexad. 8. Normal tetrad. (Fig. 3.×600, others.×930).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shown in Fig. 6. It should be noted that these three figures were observed in a squash preparation of the same sorus. In addition, it is observed that some abnormal hexads (Fig. 7) mixed with the normal tetrads (Fig. 8) were formed through meiosis of the spore mother cells in the plant. Consequently, the spores in their sporogenesis are various in size and fertility.

Subsect. Gymnosorae Kurita (1962) reported the number n=123 and suggested apogamy in *D. gymnosora*. In the present study, the author found two phases of n=123 and n=82 in the same sorus of this species.

Discussion Although chromsome number in the subsect. Formosanae H. Ito is unknown, it was found that the most of the species in the sect. Polysticho-drys H. Ito have the number both n=123 and n=82, suggesting the apogamous nature of them. Since *D. kinkiensis* having n=82 and *D. saxifraga* having n=41 are sexual species, it seems that they differ from the other species in the section in chromosome phase and in reproduction. Although both *D. indusiata* and *D. varia* have the number n=82 and are apogamous, triploid phase was not yet found in them.

All of the ferns showing two phases in chromosome number is presumed apogamous, since 32 spores are produced even in a sporangium of vigorous growth. Therefore, the presence of two phases in chromosome number of the same sorus may be taken as a characteristic criterion of apogamy at least in the genus *Dryopteris*.

Manton (1950) described various types of sporangial development in the apogamous ferns, *D. borreri* complex etc., and explained that the different chromosome numbers in the spore mother cells have been resulted from imperfect cleavage in the archesporium. According to his description, behavior of chromosome in imperfect cleavage is as follows:

'That the cleavage.....involves a passive amitotic constriction of a restitution nucleus and is not a mere inequality of anaphase distribution of normally separating half-chromosomes is proved by the complete regularity of chromosome pairing no matter how large or small a piece of nucleus may have been constricted off; this could not be attained by any process of random distribution of non-homlogous half-chromosomes but must denote the random separation of groups of split chromosomes with their halves still in close contact.'

Such a random separation, however, dose not promise to result a definite chromosome number. It is necessary, therefore, to make a further study on the

origin of co-existence of two phases in chromosome number.

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オシダ属のイタチベニ節（伊藤, 1939）に属する 12 種について染色体数を調べた。これらのうち，8 種までが n=123 を示した。すなわち，ベニシダ，トウゴクシダ，オオベニシダ，サイコクベニシダ，マルバベニシダ，ナチクジャクおよびヤマイタチシダである。他の 4 種では，イワイタチシダが n=41 の二倍体，ギフベニシダが n=82 の四倍体，ヌカイタチシダモドキとイタチシダモドキとはいずれも n=82（胞子形成数からみて，おそらくは無配生殖をする二倍体であろう）であった。

なお，n=123 を持つ種では，どの種にも，同一胞子嚢群内で，n=123 をもつ三倍性の胞子母細胞の他に，時に，n=82 をもつ二倍性の母細胞が見出された。これら染色体数の 2 型の由来と意義については，さらに研究が必要である。ただ，これらの種は，いずれも，1 個の胞子嚢中に 32 個の胞子をつくることから推して，無配生殖を営むと思われるが，このことと関連づけると，少なくともオシダ属では，2 型の存在は無配生殖を示唆するものと考えられる。

○コカナダモの学名（水島正美） Masami MIZUSHIMA: On the scientific name of "ko-kanada-mo"

本誌 40 巻 57～64 頁に生嶋・蒲谷両氏が *Elodea* の一種をコカナダモと新称され，*E. occidentalis* (Pursh) St. John (1920) の学名を当てられた。St. John 氏の Monograph of the genus *Elodea* Part I (1962) によれば，この名は **E. Nuttallii** (Planch.) St. John (1920) と改めねばならない。理由を細かく述べるのは煩雑なだけなので止めるが，*Elodea* 全種の基準標本を精検した結果，1920 年設定の名の適用が誤りであることが分ったのであった。今後コカナダモの学名を引用する時は訂正したものを用いられたい。

（東京都立大学牧野標本館）